The Falling Weight Deflectometer (FWD) is used throughout the world and at the Federal Highway Research Institute (BAST) to determine the structural strength of pavement structures. This involves a dynamic, non-destructive measuring process that can be deployed on asphalt and concrete pavements.

The FWD is installed on a trailer, and the entire FWD system is operated by computer from the towing vehicle. Measurements are always taken when stationary.

**Process**

A defined weight falls onto a rubber buffer that is placed above a base plate. This applies a load impulse to the pavement surface which simulates the axle load of a heavy goods vehicle for the measurement point. The load impulse induced is generally 50 kN. The temporal progression and maximum load impulse are recorded by an electronic load cell.

Several geophones are mounted on a bar below the FWD that is lowered to the pavement surface for measurement. The brief, completely reversible deflection of the pavement surface is measured by these geophones in the centre of the load and at several distances from it (up to 2,400 mm).

The temporal progression of deflections is recorded, and a deflection basin is composed from the maximum values at the geophone positions. The air and surface temperature at the measurement point are measured at the same time. The temperature of the asphalt or concrete structure is measured invasively depending on external factors.

To ensure the statistical reliability of the measurement, three measurements – load impulses – are usually taken in direct succession, resting for around one minute per measurement point. A support vehicle for traffic safety is generally required when conducting FWD measurements on public roads.

**Assessment**

The FWD process is used to determine the mechanical condition and thus for a qualitative assessment of road pavements. Changes to condition can be recorded and statements made about the structural homogeneity of sections of roads. When measurements are conducted on concrete roads it is additionally possible to derive information about the efficacy of load transfer over joints and about the support conditions of the concrete slabs. Recording the change to condition,
especially when combined with accelerated pavement testing using the MLS30 Mobile Load Simulator, plays an important role. For this assessment, characteristics are calculated from the deflection basin which usually evaluate the deflections on individual geophone positions or also the geometric shape of the deflection basin.

It is not, however, possible to assess the structural substance of a road pavement – in other words derive its remaining service life – solely on the basis of the results of structural strength measurements.

**Quality assurance**

In addition to in-house and external monitoring of equipment, BASf regularly conducts comparison tests of FWD measurement systems for quality assurance purposes. German and European FWD operators can take part in the comparative tests.

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**Technical data**

- Load impulse: variable, up to 150 kN (15 t)
- Impulse duration: 25 to 30 ms
- Distance between measurement points: can be freely selected, usually 25 and 100 m
- Measurement speed: stationary, approx. one minute per measurement point

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Schematic diagram (FWD on asphalt pavement)